

arV  
17042

**How to Teach**  
**BARTHOLOMEW'S**  
NATIONAL SYSTEM OF  
**INDUSTRIAL**  
**DRAWING**

✱ FREE HAND ✱  
**NEW EDITION.**



**POTTER, AINSWORTH & CO.**  
**BOSTON, NEW YORK, CHICAGO.**

Copyright, 1876 and 1881, by W. N. BARTHOLOMEW.

# PAYSON, DUNTON & SCRIBNER'S

## NATIONAL SYSTEM OF PENMANSHIP.

I.  
Introd'n

Payson, Dunton & Scribner's Copy Books, 12 Nos., per dozen,	- -	\$1 20
Payson, Dunton & Scribner's Primary Tracing Books, Nos. 1 and 2, per doz.	-	84
Payson, Dunton & Scribner's Primary Short Course, 1 $\frac{1}{2}$ , 2 $\frac{1}{2}$ , 3, 3 $\frac{1}{2}$ , 4, 5 and 6, per dozen,	- - - - -	84
Payson, Dunton & Scribner's New Manual of Penmanship,	- -	90
Payson, Dunton & Scribner's New Mounted Tablets, per set, 6 Nos.	- -	1 20

## PATENT BLOTTER COVER.

Large (for Regular Copy Book), per hundred,	- - - - -	\$1 20
Small " Primary " " " " " " " " " " " "	- - - - -	1 00

## PAYSON'S GERMAN COPY BOOKS.

German Copy Books (by J. W. Payson, of P., D. & S. System), 7 Nos., per dozen,	- - - - -	\$ .84
Elementary Tracing Book, per dozen,	- - - - -	84
German Specimen Book, Nos. 1 and 2, per dozen,	- - - - -	48
Payson's German Charts, per set,	- - - - -	1 50

Catalogues and Circulars SENT FREE on application. Correspondence solicited.

# POTTER, AINSWORTH & Co.,

107 Chambers Street,

NEW YORK.

CHICAGO.

BOSTON.

HOW TO TEACH

BARTHOLOMEW'S

National System

—OF—

INDUSTRIAL DRAWING

NEW EDITION.

---

*A MANUAL FOR TEACHERS.*

---

POTTER, AINSWORTH & CO.,

NEW YORK.

BOSTON.

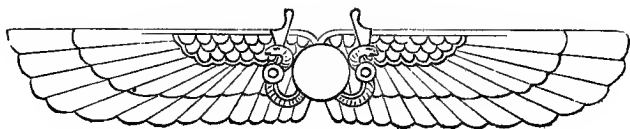
CHICAGO.

Cornell University Library  
arV17042

How to teach Bartholomew's national syst



3 1924 031 303 344  
olin,anx



## HOW TO TEACH.

---

How to teach drawing, especially to beginners, is a problem of interest to all teachers. The claims of drawing as a branch of our educational system are now fully recognized, but the results obtained in our schools have not been universally satisfactory.

This lack of success has been due to mistaken methods at the start, more than to any one cause. The child who first handles the pencil is a very different individual from the pupil of the higher grades who may be able to comprehend technical terms and to execute difficult drawings, but unfortunately the distinction has not been made in teaching the subject.

A thorough acquaintance with the principles and rules which govern the art or great skill in handling the chalk or pencil are not so much required on the part of the teacher as a reasonable understanding of the nature of the child.

Most drawing books designed for beginners, present a mass of geometrical facts and technical definitions, which are to be committed to memory by little minds totally incapable of understanding their meaning, and the methods of instruction usually employed are of a

similar character. The designs themselves are uninteresting and the methods dry and mechanical, the child being denied those aids which any draughtsman would ordinarily employ.

A free use of the ruler and other instruments is of course out of the question in the study of free hand drawing, but for the child's mind as yet unable to cope with analytic methods, and for the young muscles which, as yet, cannot readily obey the impulses of the mind, some aids must be furnished to lead up to the point where the course in drawing usually begins.

The child should be taught to draw as he was taught to walk, step by step. It is as absurd to expect him to fulfill the requirements of the average drawing book, as it would be to demand that he should walk or run at the first attempt. He needs partial support at first. He needs encouragement at each faltering step, but as he gains confidence he will also acquire greater proficiency, and in time he will be able to stand alone.

While it is desirable that the pupil should be thus gradually made acquainted with the art of drawing, it is also important that the teacher should be able to explain the reason of each step, and that she should be familiar with the best methods of imparting instruction. It is the purpose of this book to explain in a clear and practical manner, the plan of the new series of Bartholomew's Drawing Books, and to render the inexperienced teacher such aid as it may be possible to give.

#### USE OF BLACKBOARD.

A good blackboard is indispensable in teaching drawing. Its use lightens the teacher's labor, adds to the interests of the exercise, and, withal, is a great saving of time. With its aid, in most cases, more instruction can be conveyed in a few moments than can be imparted by hours of talking without it. The pupils will catch the idea much more readily by seeing the work actually done by the teacher, than they possibly can by any amount of verbal instruction.

Very early in the course, the scholars should work at the board under

the teacher's supervision. They can draw with greater freedom here than in their books, and though they are deprived of many of the guides which the book furnishes, they will be able to show what they have learned, and will gradually acquire confidence in their own ability, which it is impossible for them to obtain by drawing in the books alone.

Before the attention of the class is called to any example, an enlarged and lettered drawing of it should be made upon the board by the teacher.

It should be as accurate as possible; and, to make it so, instruments may be used if necessary. It should be drawn to a scale of sufficient size to be distinctly seen in all its details by every member of the class. Such a drawing will be found of especial service in imparting instruction.

The remark on accuracy just made is, of course, not meant to apply to the many drawings the teacher will have occasion to make, from time to time, in the way of off-hand illustration. Drawings of this class need only be sufficiently accurate to answer the immediate purpose for which they are used,—as, for instance, if the teacher wishes to show what is meant by the diagonal of a square, a figure dashed off with a few rapid strokes is just as effective as one drawn with the greatest care. Many teachers, new to the work, and feeling that their efforts will be criticised by the pupils, often waste much time at the board in their zeal to make accurate drawings when accuracy is not called for, and then frequently come short of the end aimed at. The way both to secure self-confidence in such cases, and to make a favorable impression upon the class, is to attempt no more than what is necessary for the purpose in view, but to attempt that boldly. The time for the teacher to perfect herself in black-board drawing is not when her pupils are before her, waiting for instruction, but when she is alone, or with those whose presence causes no embarrassment. A few suggestions here, in regard to the method of such practice, may not come amiss.

In making a drawing upon the board, the centre of the figure should be about on a level with the eye. Lines considerably above or below

this point are not easily drawn. As far as practicable, stand so as to keep the work, during its progress, directly before you; since it is impossible to judge accurately of a line which is at any great distance to the right or left, in respect to its length, position, and relation to other lines. In drawing a line in any direction, it will usually be found most convenient to hold the chalk so that it shall form an acute angle with the board. In drawing a vertical line, place the chalk on its upper extremity, and let the arm slowly descend by its own weight. In the case of any line, whether straight or curved, where precision is required, always place points to indicate its extremities, or mark its course. In making a drawing, have regard to the work as a whole, while executing the parts; and, in drawing a line, keep the eye on the point to be passed through or reached, rather than the point of the chalk while in motion. After having finished a careful drawing of some subject which has occupied perhaps ten minutes, more or less, make a second one of the same subject in one-half the time, then another in a shorter time still, and, finally, one as rapidly as the lines can be drawn. It will, of course, be understood, that, in these last cases, points are not to be placed. In critically examining the work, as a rule, stand at a distance from it equal to three times its longest measure, and directly before it.

#### CLASS DRILL.

Pupils in the same class must be *kept together*. All should be at work on the same subject at the same time. The advantages of class instruction over individual instruction are just as great in drawing as in any other study; and the teacher should avail herself of these advantages for her own benefit as well as for that of her class. When all are at work on the same example, all need the same instruction, and the teacher will have time to give full and explicit directions.—time to examine the class to see if the information imparted has been received, understood, and acted upon, which would be impossible if all were not engaged on the same work at the same moment.

So far as it is practicable in these earlier lessons, every point that is



made and every line that is drawn should be dictated. If allowed to draw at will, the greater number will be very likely to do so without thought; the exercise will be of little or no profit to them; and the results produced will be such as to exhaust the patience of the teacher far more than the effort that may be required to guide the class. Try the experiment; and, if you are satisfied with nothing short of the *best results*, you will adopt this suggestion.

There should be an occasional exercise in drawing from memory. After the example selected for this purpose has been drawn from sight, it should, in this way, be reproduced on the board. This exercise is particularly calculated to strengthen this faculty of the mind, and so give one the power of recalling at will such forms as have been at any time the subject of careful study or close observation.

#### PENCILS.

The teacher should use her best efforts to have the pupils provided with *good pencils*. The quality of the pencil used by the beginner is a matter of vastly more importance than is usually supposed. A poor one, in his hands, is a constant source of discouragement: it is a stumbling-block in the way of his success. As to the matter of economy, "cheap pencils" are dear at any price. One *good one* will outlast a half-dozen poor ones. The lead of a poor pencil is tender; and hence, in the process of sharpening, it is frequently broken: in using it, it snaps off every now and then, even under a moderate pressure; and, besides, it must be frequently sharpened to get rid of some little particle of grit at the point, which scratches the paper in drawing; and the result is, it is soon used up.

The pencil commonly known as the "Eagle Pencil" will meet the wants of the beginner; the "Eagle" pencil No. 3, or the "Eagle Academic" marked "Hard," will probably be the most desirable pencils. If these are found too hard, use the "Eagle" No. 2½, or the "Eagle Academic" marked "Medium." The "Academic" is a new grade of pencils prepared especially for drawing purposes. The quality is excellent,

and yet the price is less than that of the regular "Eagle" pencil. In sharpening the pencil, the wood should be cut back three-fourths of an inch, at least, from the point; the taper should be regular; and for most purposes the point should be fine. This work should be done, so far as convenient, under the supervision of the teacher. Nothing has yet appeared in the way of a pencil-sharpener that will at all compare with a good pocket-knife, for convenience or usefulness. The edge should be keen, and the blade of good width; a narrow blade being less easily guided than a broad one. In case it is simply required to point the lead, a piece of fine sand-paper will be found very serviceable.

The drawing-pencil should be used only for drawing. When it is so far used up that the upper end falls below the upper joint of the fore-finger, it is too short for this purpose, and it should be laid aside, or spliced out by fitting the end of the pencil to a metallic tube of suitable size and convenient length. If the two are not exactly of the same size, it is a matter of no special importance. A tube such as is needed, is to be had at the stationer's for a few cents.

As a rule, the pencil should be held so as to allow its point to project an inch or more beyond the end of the fore-finger; the fingers and thumb should be slightly curved, the wrist and the side of the hand resting on the desk. With the hand placed and the pencil held in this way, lines may be drawn with freedom in any required direction. Unless otherwise instructed, children invariably hold the pencil too near the point, grasp it too firmly, and bend the thumb and fingers too much; thus cramping the hand to such an extent as to make it absolutely impossible to draw with any degree of freedom. No pains should be spared to secure a correct habit in these particulars; to bring this about, constant attention and persistent effort will be required.

#### ERASERS.

The most convenient form of eraser is that known as the "Diamond Rubber." It is a great improvement on the old rectangular form. The angles being acute, there is nothing to prevent the operator from seeing

just what he is doing when using it : this makes it exceedingly valuable to the draughtsman.

On the surface of all manufactured rubber there is a kind of enamel, which must be removed before the article can be used for the purpose of erasing. This may be done by briskly rubbing it on hard, rough paper ; or it can be cut away with a sharp knife, first wetting the blade. When once the rubber is in condition for use, it will remain so, unless laid aside for some considerable time. If, however, it becomes coated, the remedy is simple, and always at hand.

There should be some rule in regard to the use of the eraser. This will be absolutely necessary in all cases where the pupils draw at the dictation of the teacher. If each one is permitted to correct his errors as he goes along, it will be practically impossible to keep the class together. The only way is to let the errors made stand until such times as the pupils may be directed to correct them. Just when this work should be done, and how often, each teacher must decide for herself : it depends upon so many circumstances, that no one unacquainted with them can offer a suggestion likely to be of much service.

In all cases, the imperfect line should be retained until a correct one has been made : it should and will serve as a guide to something better. When a line is to be erased, the one to be retained should be protected by covering it with the edge of a stiff piece of writing paper. It is sometimes convenient, in erasing, to cut a slit out of the paper used to protect the drawing ; and then, by placing this so as to expose the part to be erased through the opening, the latter can be easily removed without endangering other parts of the work.

#### POSITION OF PUPIL.

The pupil should sit facing the desk, with his feet upon the floor, his body from the hips inclining a little forward, his shoulders thrown back, his head up. This posture, while the one most favorable for work, will also be found, when the pupil has become wonted to it, the easiest to maintain. It is, moreover, conducive to health, as it neither cramps the

chest, curves the spine, nor brings the eye too near the paper for its own good. The teacher, having impressed upon the pupils the importance of correct position in these respects, and shown them also how far their good appearance as a class depends upon it, should insist upon entire conformity to the rule on the part of every pupil. To secure this, constant vigilance and frequent admonition may, for a time, be necessary; but soon, what may seem difficult at first from its novelty will grow easy through practice, till ere long it becomes habitual.

Children, and beginners generally, are very apt to turn the book, especially when drawing vertical or inclined lines. As a rule, while the book may be moved to the right or left, brought near or removed from the pupil as suits his convenience, the lower side of it should be kept parallel, or nearly so, to the front of the desk.

Sometimes, however, in drawing oblique lines, as well as certain curves, the book may be turned sufficiently to avoid any constrained or unnatural position of the hand or arm, but not to the extent of treating all lines as though they were horizontal or vertical. And the teacher should never, either for the sake of securing more correct drawings or any other reason, permit her pupils to do more than this, or, what in many cases amounts to the same thing, simply shut her eyes to any habitual departure from the rule. Both teacher and pupil should bear in mind that the object sought is the training of the eye and hand—the acquisition of *power*, the attainment of a skill useful in almost every department of human industry and life,—the drawing itself being the means rather than the end, the natural consequence rather than the object.

#### THE ORDER IN WHICH LINES SHOULD BE DRAWN.

In making the outline of any figure, and in drawing its detail, we should, as far as possible, so proceed that neither the pencil nor the hand will obstruct the view of what has been previously drawn. Speaking in general terms, it may be said that this end is best secured by beginning at the upper left-hand corner of the drawing, and working grad-

ually towards the lower right-hand corner. By adopting this course, an opportunity of forming correct judgments is given, while to pursue an opposite one would, in many instances, deprive us of the means of doing this.

In determining the order in which the lines composing a figure should be drawn, there is another point to be considered. If there are certain lines in the drawing difficult to execute, crossing, or lying in close proximity to others less difficult to make, the former, when it is practicable, should be drawn first. By taking this course, if failures are made, and it becomes necessary to erase a line, it can be done with less injury to the drawing than would otherwise be the case.

As a rule in this book where *numerals* are placed beside the lines in an example, they indicate the order in which the lines should be drawn; while the *letters*, besides serving the purpose of designating the various points and lines, indicate the order in which the points are to be placed; that is, the points are always to be placed in the drawing in the alphabetical order of the letters which mark them in the example; thus the point A is to be first placed, B next, then C, next D, and so on.

#### GEOMETRICAL TERMS.

Geometry forms the basis of drawing. Many of the terms used in the former are of frequent use in the latter. The correct use of these terms and an exact knowledge of their meaning is of the greatest importance, and yet how frequently do we find even those terms in common use incorrectly applied by those whose business it is to instruct others. For example: in speaking of a line, A says it is not *perpendicular*. The idea she intends to convey is that the line is not *vertical*. Again she says of a line, "It is not *straight*," meaning that it is not *horizontal*. Then, in illustrating the definition of a *horizontal* line, she asks, pointing to the line, "What *kind* of a line is this?" The correct answer would be a straight line, or a curved line, as the case may be. The answer she would have is, perhaps, "a *horizontal* line." Then she talks about the *centre* of a line when she means the middle point, and again she makes

an improper use of the term *diameter* when she applies it to a line passing through the centre of a square or other rectangular form and terminating in its opposite sides. She is no less in error than she would be if she applied the term *circumference* to the sides of the square, or the term *radius* to a line connecting the centre of the square with any point in one of its sides.

The teacher who makes an incorrect use of terms is teaching error for truth and, more than this, she is aiding her pupils in the formation of a habit of which they may never rid themselves, even though they early discover the errors taught them in the primary school.

In defining a term, the language and such other means as may be employed, should be well considered. Say to a child that a *point* has no magnitude; that a *line* has length but no breadth or thickness; that a *vertical line* is one that is perpendicular to the plane of the horizon, and it is a matter of no consequence whether you address him in Choctaw or English. The result will be the same.


The terms used in this book are for the teacher, and the language used in defining them, is addressed to her and not to her pupils. Such terms as she may use in instructing her class, she must define in language with which they are familiar, and the meaning of which they understand.

A word about the introduction of terms. When shall they be introduced, and how rapidly? The teacher in charge of a class should be the person best fitted to answer these questions, for she ought to know better than any other person what the class is able to receive and comprehend. The exercises given on page 1, Book 1, furnish an opportunity to introduce to the class the following terms, *point, line, straight line, horizontal, vertical, parallel, perpendicular, angle, right angle and rectangle*. To introduce all of these terms and define them to the understanding of the class, and to so teach them that they can be used intelligently would evidently be an overdose for little folks. The teacher will bear in mind that this is not the only opportunity she will have to present these terms. Every page in the book will afford as good an illustration as the examples referred to, and, more than that, any illustration that the teacher may

desire to use can be put on the board at any time. The only suggestions which we would offer at this point are these: After a term has been used and defined, do not present another until the class has become somewhat familiar with that already furnished. When a term is used for the first time always illustrate its meaning by accurate drawings on the board, and, further, require the pupils to find something about the school-room to which the term applies.

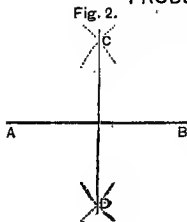
In drawing on the board where accuracy is essential, an acquaintance with a few simple problems in practical geometry will often be of service, and as there may be those who lack this knowledge, it seems advisable to introduce these problems here. Let them be worked out on the board. Use a ruler in drawing straight lines, and a string in drawing circles or arcs of circles. In selecting a string

Fig. 1. for this purpose, choose one whose length will not be perceptibly increased by any ordinary strain. There should be a loop at one end sufficiently large to admit of the introduction of one end of the crayon so that it will play freely within the loop when in use. In drawing a circle or arc proceed as follows: Suppose it is desired to draw a curve through A and that B is the centre or point from which the curve is to be drawn. Having the chalk within the loop, place one end on A, as here represented, and, holding the string taut, place it on B. Keeping it there with the thumb of the left hand, revolve the chalk about B.



## PROBLEMS.

PROBLEM 1. Figure 2. — *To bisect a given line, A B.*



1. From the points A and B as centres, with a radius greater than half of A B, describe arcs intersecting each other above and below the line, as at C and D.

2. Through the points C and D draw C D, and it bisects A B.

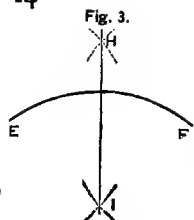
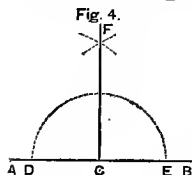


Figure 3 — To bisect a given arc, EF.

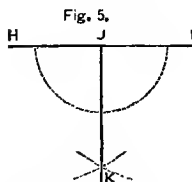
With E and F as centres, describe intersecting arcs above and below the line, as in Figure 2. Draw HI, and it bisects the arc.

PROBLEM 2. Figure 4. — At any point, C, of a given line, AB, to erect a perpendicular to the line.



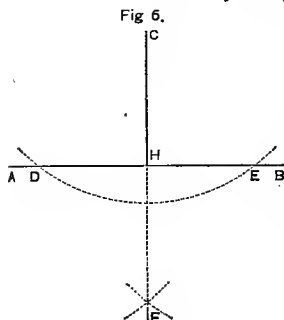
1. From C as a centre, with a radius less than half of AB, describe an arc meeting AB at points D and E.
2. From D and E as centres, with any radius greater than DC, describe arcs cutting each other in F.
3. Draw FC, and it is the perpendicular required.

Figure 5. — To let fall a perpendicular to HI from J.



Proceed as in Problem 2, Fig. 4.

PROBLEM 3. Figure 6. — From any point, C, without a given line, AB, to let fall a perpendicular to AB.

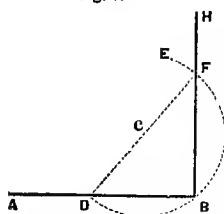


1. From C as a centre, with a radius sufficiently great, describe an arc cutting the line AB at the points D and E.
2. From D and E as centres, with a radius greater than half of ED, describe arcs intersecting in F.
3. From C draw CH in the direction of F, and CH is the perpendicular required.



PROBLEM 4. Figure 7.—To erect a perpendicular at the extremity, B, of a given line, A B.

Fig. 7.



1. From any point without the line, as C, with a radius equal to C B, describe an arc cutting A B in D.

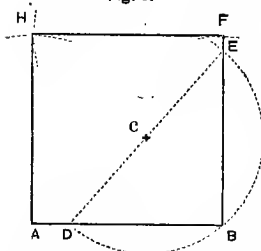
2. Draw a line through D and C to meet the arc in F.

3. Through the points F and B draw H B, the perpendicular required.

If it is required to erect a perpendicular at a point near the extremity of a line, this is the most convenient method of doing it.

PROBLEM 5. Figure 8.—On a given line, A B, to construct a square.

Fig. 8.



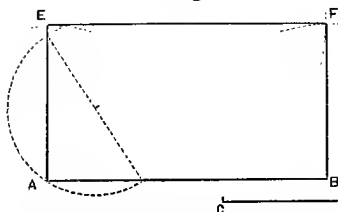
1. At the point B erect a perpendicular, B F, making it equal to A B.

2. From the points A and F, as centres, with a radius equal to A B, describe arcs intersecting in H.

3. Draw A H and H F, and A B F H is the square required.

PROBLEM 6. Figure 9.—To construct a rectangle, two sides, A B, and C D, being given.

Fig. 9.



1. At the point A, of the line A B, erect a perpendicular equal to C D.

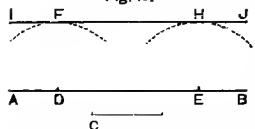
2. From E as a centre, with a radius equal to A B, describe an arc over B. From B as a centre, with a radius equal to C D, describe

an arc intersecting the former arc in F.

3. Draw E F and B F, and A B F E is the rectangle required.

PROBLEM 7. Figure 10.—*To draw a line parallel to a given line, A B, and at a distance from it equal to the measure of the line C.*

Fig. 10.

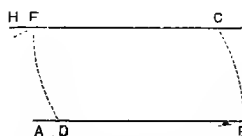


1. From any two points, as D and E, in the line A B, with a radius equal to the line C, describe two arcs above A B.

2. Draw the line I J, touching, *but not cutting*, the arcs which have just been described, at the points F and H; and I J is the parallel required.

PROBLEM 8. Figure 11.—*Through a given point, C, to draw a line parallel to a given line, A B.*

Fig. 11.



1. From C as a centre, with any radius, describe an indefinite arc cutting A B in D.

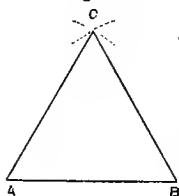
2. From D as a centre, with the same radius, describe the arc C E.

3. From D as a centre, with a radius equal to the distance between the points C and E, describe an arc cutting the indefinite arc in F.

4. Draw a line through the points C and F, and it is the parallel required.

PROBLEM 9. Figure 12.—*To construct an equilateral triangle, the length of the base, A B, being given.*

Fig. 12.

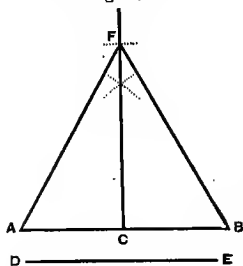


1. From the points A and B as centres, with a radius equal to A B, describe arcs intersecting in C.

2. Draw C A and C B, and the triangle A B C is equilateral.

PROBLEM 10. Figure 13. — *To construct an isosceles triangle, the base,  $AB$ , and its altitude,  $DE$ , being given.*

Fig. 13.

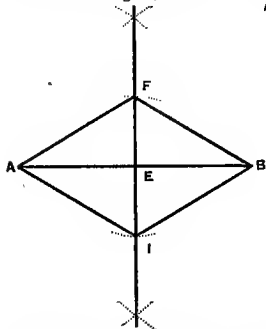


1. Find  $C$ , the middle point of  $AB$ , and at this point erect a perpendicular equal to  $DE$ .

2. Draw  $AF$  and  $FB$ , and the figure  $AFB$  is the triangle required.

PROBLEM 11. Figure 14. — *To construct a rhombus, one of its diagonals,  $AB$ , and the measure of the other,  $CD$ , being given.*

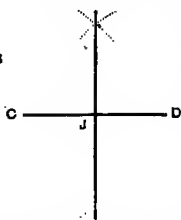
Fig. 14.



1. Bisect  $AB$  and  $CD$ .

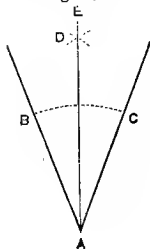
2. From  $E$  as a centre, with  $CE$  as a radius, describe arcs above and below  $AB$ , cutting the line bisecting it at  $F$  and  $I$ .

3. Draw  $AF$ ,  $FB$ ,  $BI$ , and  $IA$ , and  $AFBI$  is the rhombus required.



PROBLEM 12. Figure 15 — *To bisect a given angle. FIRST METHOD.—Let  $A$  be the given angle.*

Fig. 15.



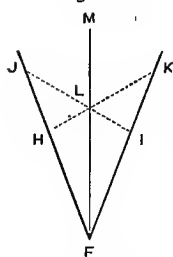
1. From  $A$ , with any radius, describe an arc, as  $BC$ , cutting the sides of the angle.

2. From  $B$  and  $C$  as centres, with any radius greater than one-half of  $BC$ , describe arcs intersecting in  $D$ .

3. Through  $D$  and  $A$ , draw  $EA$ , and it bisects the angle.

Figure 16. SECOND METHOD.—To bisect the angle F.

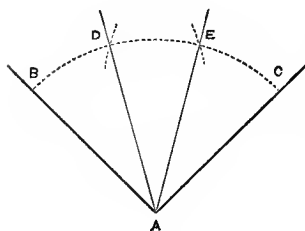
Fig. 16.



1. On J F place any two points, as H and J.
2. Make F I equal F H; make I K equal H J; draw J I and H K.
3. Through F and L draw M F, and it bisects the angle.

PROBLEM 13. Figure 17.—To trisect a given right angle, A.

Fig. 17.



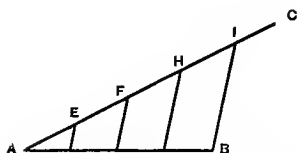
1. From A as a centre, with any radius, describe an arc, as B C, cutting the sides of the angle.

2. From B and C as centres, with the same radius, describe arcs cutting the arc B C in D and E.

3. Through D and E draw A D and A E. These lines trisect the angle.

PROBLEM 14. Figure 18.—To divide a given line, A B, into any number of equal parts, say four.

Fig. 18.



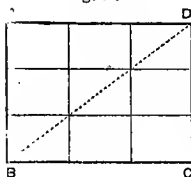
1. From either extremity of A B, draw a line, A C, of any length, and making any angle with A B.

2. From A, lay off on A C four equal measurements, A E, E F, F H and H I.

3. Connect I with B, and from the points H, F and E draw lines to meet A B, parallel to I B, and they divide A B as required.

PROBLEM 15. Figure 19.—To divide a given rectangle,  $B C D A$ , into a number of rectangles, say nine; each similar to the whole.

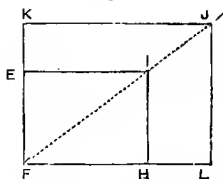
Fig. 19.



1. Divide  $A B$  into three equal parts, and from the points of division draw lines parallel to  $B C$ .
2. Draw a diagonal,  $B D$ , and through the points of intersection draw lines parallel to  $A B$ .

PROBLEM 16. Figure 20.—On the line  $F K$ , to construct a rectangle similar to a given rectangle,  $F H I E$ .

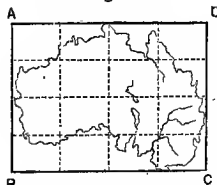
Fig. 20.



1. Draw the diagonal,  $F I$ , and produce it indefinitely.
2. Draw  $K J$  parallel to  $E I$ , to meet the diagonal produced.
3. Produce  $F H$ , making  $F L$  equal to  $K J$ , and draw  $J L$ .

The draughtsman often has occasion to make an enlarged or reduced copy of a drawing. His task in such a case is greatly simplified by making use of this problem in connection with the previous one. Suppose it is required to make an enlarged copy of the map of Australia, given in Figure 21.

Fig. 21.

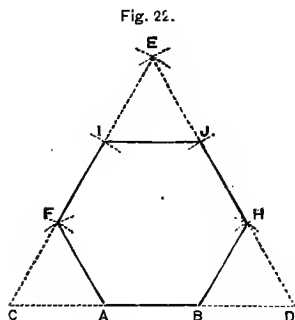


1. Enclose it within a rectangle,  $B C D A$ .
2. Construct a figure similar to  $B C D A$ , as in Problem 16, Figure 20, and as much larger as the copy is to be larger than the map.
3. Divide  $B C D A$  into a number of similar rectangles, as in Problem 15, Figure 19, the greater the number, the more accurate the copy

is likely to be. In this case, let the number be sixteen.

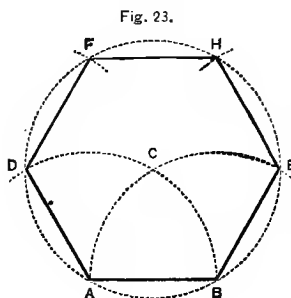
4. Divide the rectangle constructed into sixteen similar rectangles.
5. Copy within each division that portion of the map found in the corresponding division of B C D A.

PROBLEM 17. Figure 22.—*To construct a regular hexagon upon a given line, A B.*



1. Produce A B to the right and left, making B D and C A each equal to A B.
2. On the line C D, construct the equilateral triangle, C D E.
3. Taking A B as a measure, divide the sides C E and D E each into three equal parts.
4. Draw the lines B H, H J, J I, I F, and F A, and A B H J I F is the hexagon required.

Figure 23.—SECOND METHOD.—*To construct a regular hexagon upon a given line, A B.*

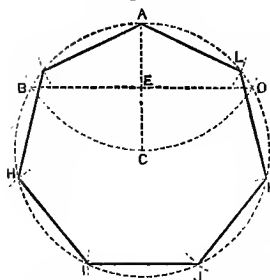


1. From A and B, as centres, with the radius A B, describe two arcs intersecting C.
2. From C as a centre, with the same radius, describe a circle.
3. From the points E and D, the intersections of the arcs with the circumference of the circle, as centres, describe arcs cutting the circumference in F and H.
4. Draw B E, E H, H F, F D, and D A, completing the hexagon required.

PROBLEM 18. Figure 24.—*To construct a regular heptagon.*

1. Draw a circle, and a radius C A.

Fig. 24.



2. From A, as a centre, with a radius A C, describe an arc, cutting the circumference in the points B and D, and draw B D intersecting C A in E.

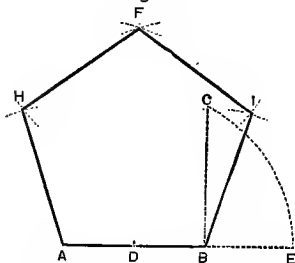
3. From any point, as A, lay off the distance B E seven times upon the circumference. Connect the points of the division, and A F H I J K L is the required heptagon. There is no absolutely exact method of constructing a regular heptagon. The one

given is a good approximation.

For all practical purposes such an approximation as this is all that is necessary.

PROBLEM 19. Figure 25.—*To construct a regular pentagon upon a given line, A B.*

Fig. 25.



1. Produce A B towards E, and draw B C perpendicular and equal to A B.

2. Bisect A B at D, and with D as a centre, and the distance D C as a radius, describe an arc meeting A B prolonged in E.

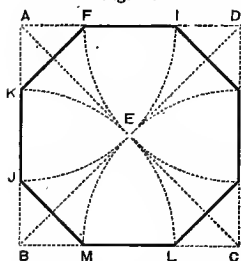
3. From A and B as centres, with a radius equal to A E, describe arcs intersecting in F.

5. From A and F as centres, with A B as a radius, describe arcs intersecting in H; from B and F as centres, with same radius, describe arcs intersecting in I.

5. Connect the points A, H, F, I, B., and the resulting figure is the pentagon desired.

PROBLEM 20. Figure 26.—*Within a square to inscribe a regular octagon.*

Fig. 26.



1. On the line B C, construct the square B C D A.

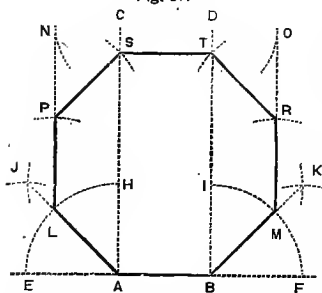
2. Draw the diagonals C A and B D intersecting in E.

3. From the points B, C, D, and A, as centres, with a radius equal to B E, describe arcs cutting the sides of the square in the points M, L, H, N, I, F, K, and J.

4. Connect the points of division.

PROBLEM 21. Figure 27.—*On a given line, A B, to construct a regular octagon.*

Fig. 27.



1. At the points A and B erect the perpendiculars A B C D and.

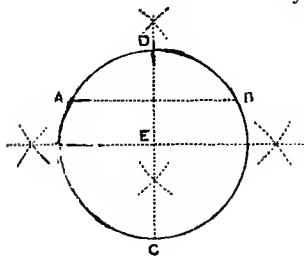
2. Produce A B to the right and left, and bisect the angles C A E and D B F by the lines A J and B K; make A L and B M equal to A B.

3. Draw L N and M O parallel to A C, and make L P and M R each equal to A B.

4. From P and R as centres, with a radius equal to A B, describe arcs cutting A C in S and D B in T.

5. Draw P S, S T, and T R.

PROBLEM 22. Figure 28.—*To find the centre, a diameter, and radius of a given circle.*



1. Draw a chord between any two points, A and B, in the circumference.

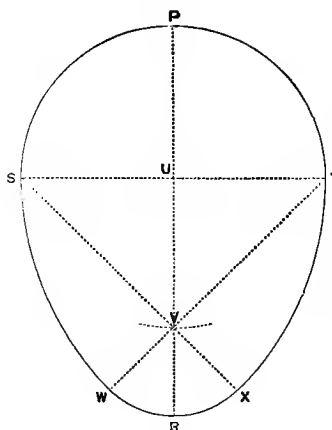
2. Bisect the line A B by a perpendicular D C.

3. Bisect the line D C. The point E, where the bisecting line crosses D C, is the centre of the circle, D C is a diameter, and E D a radius.



PROBLEM 23. Figure 29.—*To describe the common egg oval; the minor axis, S T, being given.*

Fig. 29.



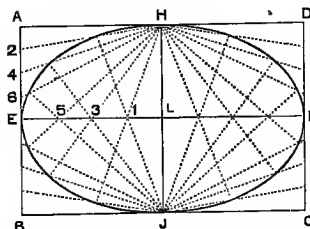
1. Bisect S T by the perpendicular P R; from U as a centre, with S U as a radius, describe the arc S P T, and the arc at V.

2. Through V draw S X and W T of indefinite length. From S and T as centres, with S T as a radius, describe the arcs S W and X T.

3. From V as a centre, with the radius V W, describe the arc W R X.

PROBLEM 24. Figure 30.—*To describe an ellipse; the major axis, E F, and the minor axis, H J, being given.*

1. Draw the rectangle, A B C D, enclosing the axes of the ellipse, making the side B C parallel to E F.



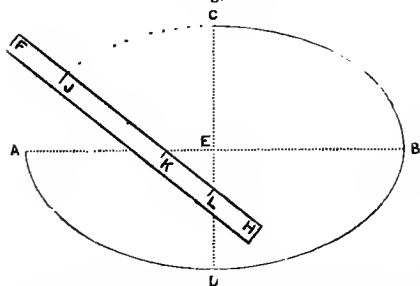
2. Divide A B, D C, and E F into a like number of equal parts, making the number even, as 6, 8, 10, or more. Let the number in this case be 8.

3. From 2, 4, 6, and from corresponding points in D F, draw lines to H. From the points placed in E B and F C draw lines to J. From J and H draw lines through 5, 3, 1, and through corresponding points in L F, to meet those already drawn. Through the intersections of 2 H with J 1, 4 H with J 3, etc., draw the outline of the figure.

Figure 31.—SECOND METHOD. *To describe an ellipse; the major axis, A B, and the minor axis, C D, being given.*

1. On a slip of paper having one edge, F H, straight, mark J L equal A E, one-half the major axis, and J K equal C E, one-half the minor axis.

Fig. 31.



2. Place the paper, as shown in the figure. The point L is on the line C D; and K is on A B. Make a dot at J.

2. Move the paper, always keeping the points K and L on the axes, and with every new position mark the place of the point J; and, when a sufficient number of points have

been placed, draw the curve. The nearer the points are to each other, the more accurate the drawing is likely to be.

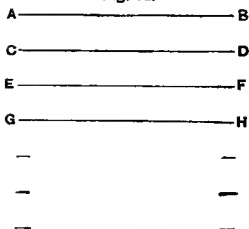


## BOOK I.

BOOK I deals with straight lines only. How should straight lines be drawn? The general answer is: Begin by placing points to mark the extremities. In this book these points are given, as enough is required of the young pupil without calling upon him to do this. Horizontal lines should be drawn from left to right. Vertical lines should be drawn with a downward stroke. The fore-arm should be held as nearly as possible at right angles with the line to be drawn. This, in drawing horizontal lines, will bring the elbow near the side. In drawing a vertical line the arm will be placed well up on the desk.

## PAGE 1.

Fig. 32.



**EXERCISE 1.**—Put the example on the board as it is found in the book, making two strong lines, two faint ones, and placing points below.

Use this drawing in showing the pupils just what is required of them. The two faint lines are to be made equal in strength to those above them. Before doing this, require the pupils to pass the point of the pencil carefully over the

line E F, without touching the paper, following the exact course of the line. Let this be repeated several times. When the hand has become somewhat accustomed to the motion, place the pencil point on E, and with a moderate uniform movement of the hand, make the line of the strength required. In like manner proceed with the line G H. Next, the points below are to be properly connected with a faint line, passing the pencil between the points a few times before sketching the line. Having a reasonably accurate sketch, strengthen it, as was done in the case of E F and G H. In like manner continue the exercise. To avoid repetition, it may be here remarked that this course should be pursued in all cases.

**EXERCISE 2.**—The course pursued in Exercise 1 should be followed here. In drawing or tracing the lines, see that the fore-arm is well up on the desk.

If the teacher deems it advisable to use the terms *horizontal* and *vertical*, she should so use them that they name something already known to the child. It is useless to commit to memory the definitions of terms, unless they are understood by the pupil. They do not help him to draw.

To the children, a *horizontal* line may be defined as one in which all parts are of the same height, one point no higher than any other point. A *vertical* line may be defined as one that is upright, one that does not lean, incline, tip, etc.

This may be best illustrated by holding a ruler or pointer in the proper positions. This is especially true in case of a horizontal line. If the illustration is given on the board alone, the pupil is almost certain to get the impression that all horizontal lines tend from right to left, or left to right. Any line that can be drawn on a horizontal plane, either real or imaginary, is a horizontal line.

The scholars may be called upon to point out horizontal lines, such as the cracks in the floor, the edges of the window sills, sashes, etc. In this way the teacher may ascertain whether the pupils have correctly understood the instruction given.

The main object to be attained now is the training of the untrained arm, hand and fingers. The teacher's own good judgment will decide how early technical terms are to be employed.

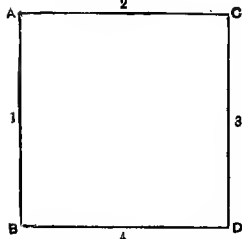
EXERCISE 3.—This is a combination of the preceding exercises. The suggestions already given apply here.

EXERCISE 4.—This is an arrangement of horizontal and vertical lines, forming right angles. The faint lines in the examples are simply to be traced. In doing this, proceed as in the preceding exercises. If the vertical line in each example is drawn before the horizontal line connected with it, neither the hand nor the pencil will obstruct the view as the drawing proceeds.

EXERCISE 5.—This example gives the leading or principal lines of a well known border of ancient date. The element used in this design is a combination of the horizontal and vertical line. The pupil is simply to

trace the fine hair lines, leaving the dotted lines as they are. It will be understood hereafter that dotted lines are not to be traced, unless so directed.

## PAGE 2.

Fig. 33.  
2

**EXERCISE 6.**—The pupil will not now need to know all that may be known about a square. His attention may be called to the fact that the figure has four sides, and that these sides are of equal length; that the adjoining sides form four right angles, such as he drew on page 1, and that, in this case, two of the sides are vertical and two horizontal.

In drawing a square on the board, place points for the extremities of the sides, in the order indicated by the letters A, B, C and D. Draw the lines in the order indicated by the numerals. By so doing, no part of the drawing is concealed by the hand while in process of completion. The pupil should follow the course here indicated in tracing or drawing in his book. Care must be taken to see that the pupils do not, either in tracing or in drawing, extend the lines they make beyond the points given, nor fall short of reaching them.

The teacher cannot be too careful in her work at the board. If she is careless and inaccurate, the pupils will not be slow to imitate her in this particular. If she desires accuracy from them, she must be accurate herself. Then again, the teacher's drawing, good or bad, has a further educating influence. If accurate, it is a help; if inaccurate, it is a hindrance to the success of the pupil. These remarks, of course, apply to drawings which are to remain on the board, to be seen and talked about during the exercise.

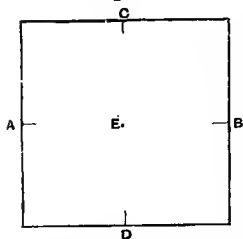
One square in Exercise 6 is to be traced, and the other drawn, the extremities of the lines being given.

**EXERCISE 7.**—This is a well known border. It is composed of a series of squares, arranged at regular intervals. One side of each square

is omitted. The pattern is given complete, and then arranged to combine tracing and drawing.

## PAGE 3

Fig. 34.



**EXERCISE 8.**—The square is here divided into four smaller squares, by vertical and horizontal lines. In drawing on the board, place points, as A, B, C and D, in the middle of each side of the square, placing them in alphabetical order. It may be well to place a point, as E, where the dividing lines should intersect, before drawing them.

**EXERCISE 9.**—This is a border in which the square, divided as in Exercise 8, is used as the basis of the design.

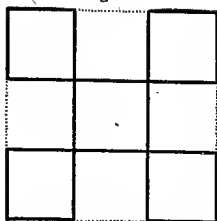
## PAGE 4.

**EXERCISE 10.**—In this case the sides of the square are divided into thirds. Place points dividing the upper side first. This line, if accurately divided, will be a help in dividing the remaining sides. Special care should, therefore, be exercised in securing an accurate division of this line. In making the drawing on the board, proceed as suggested in the instructions for drawing the previous exercises. When the square is accurately divided, the lines bounding the central square are to be strengthened, and the guide lines may then be erased. The figure is first to be traced by the pupil, and then he is to draw it at the right. With the exception of locating points of division, the pupil will follow the course just indicated for blackboard work.

**EXERCISE 11.**—This is a border produced by the repetition of the figure in Exercise 10. The guide lines which the pupil must draw to locate the central square should be very faint, and may be erased when its outline is strengthened. In doing this, place a piece of stiff paper with a straight edge on the part of the drawing that is to be preserved, leaving the part to be erased exposed; then, holding it firmly in place, erase the lines not wanted.

## PAGE 5.

Fig. 35.



**EXERCISE 12.**—The division of the square in this Exercise is the same as in Exercise 10, different lines being strengthened in the final drawing. A good exercise for the board will be to allow the children to draw the faint lines that divide the square into the nine smaller ones, and strengthen such lines as they please, thus obtaining new figures, as, for example, the one given here.

**EXERCISE 13.**—In this case the teacher will need to be particularly careful to see that the pupils do the work required neatly and accurately, having each line begin and terminate where it should. The pencil must be well pointed, so that the pupil can see distinctly where the lead comes in contact with the paper. Neatness of execution is the leading thing to be sought after in this exercise.

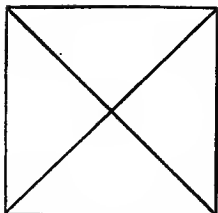
## PAGE 6

**EXERCISE 14.**—We have here a border of Eastlake pattern. This exercise contains both obtuse and acute angles, and, if the teacher deems it desirable, she may call the attention of the class to these angles. If this is done, special instruction with regard to them should be given on the board, by illustration of the obtuse and acute angles independent of other lines. In connection with this, the pupils should be called upon to point out these angles in objects about the room. A book may be opened more or less to show this, or rulers may be held so as to illustrate it.

**EXERCISES 15 AND 16.**—These are borders of the herring-bone pattern. The fine lines are to be strengthened, and corresponding lines are to be drawn in the blank spaces. See that in each case a complete and satisfactory sketch of the entire border is made before any of the lines are strengthened. By pursuing this plan errors are avoided, or easily corrected, and the work will be in every way more satisfactory.

## PAGE 7.

Fig. 36.



**EXERCISE 17.**—A square and its diagonals. In drawing the diagonals it may be well to place a point where the lines should intersect, as was advised in drawing the lines in Exercise 8. This will be particularly desirable when the pupils are drawing on the board, as the distance between the extremities of the diagonals will then be considerable.

**EXERCISE 18.**—Is simply a repetition of squares, with their diagonals. Ask such questions as will lead the class to observe this before the drawing is commenced. The upper figure furnishes an exercise in strengthening lines already drawn, and the lower an exercise in drawing.

Do not permit any line to be strengthened till all have been sketched faintly, and satisfactorily.

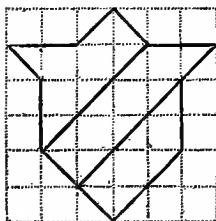
## PAGE 8.

**EXERCISE 19.**—The teacher will observe that the oblique lines are diagonals of the four small squares, into which the outer square is divided.

**EXERCISE 20.**—This is a zigzag border formed by a combination of the figures given in Exercise 19. Complete the border in the first exercise by strengthening the lines requiring it, and in the figure below repeat the example. As in previous lessons, require a complete sketch before the lines are strengthened. To avoid repetition, let it be understood that this course should be pursued in all cases.

## PAGE 9.

Fig. 37.



**EXERCISE 21.**—A shield. It will be unnecessary for the scholar to know the sub-divisions of the square in this case, as all needed points are given. In drawing the figure on the board, the teacher can readily find the points by dividing each side into sixths, and connecting the opposite points, as shown in the diagram.

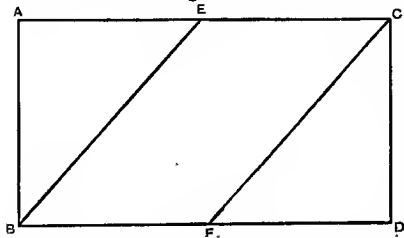


**EXERCISE 22.**—Call the attention of the class to the line of squares forming the leading figure in the border. Explain to them that these figures are squares, although in a different position from any squares they have previously drawn. The dotted lines, where the example is to be drawn, are the construction lines necessary to secure accuracy in drawing. The intersection of these lines with each other furnishes points, giving the length and direction of the lines to be drawn. This Exercise, and also Exercise 20, are good subjects for black-board work.

## PAGE 10.

**EXERCISE 23.**—The figure given in this Exercise is a rectangle. A rectangle has its opposite sides equal. Its adjoining sides may be equal or they may not, and the angles are right angles. This term is a general one. It applies to any figure in which these conditions are found.

Fig. 38.



The square is a rectangle.

It will be a good black-board exercise for the class to draw this figure, the teacher dictating each step in the work. It will be well to vary the proportions of the figure, making the long sides of some definite length, as compared with the short sides. If the exercises are conducted in this way, the pupils will be more likely to obtain a correct understanding of what a rectangle is. The figure drawn, have the sides divided into halves, fourths, etc., and dividing lines drawn, in one case parallel to the sides of the figure. In another, the lines may be inclined, and again both exercises may be combined in one.

**EXERCISE 24.**—In this case the oblique lines,  $EB$  and  $CF$ , form, with the horizontal lines  $EC$  and  $BF$ , a figure called a rhomboid. Its opposite sides are equal and parallel, and its opposite angles are equal, but the angles are not right angles.

As to the use of these technical terms before the class, as has been

already stated, the teacher must use her own judgment. All that can be said here is: Never use a term for which the pupil is not prepared. A child, when very young, uses the word "house," because he has an idea for which the word house is a name. Had he never seen a house, his idea of one would certainly be very vague, if all his information were derived from the statement that "a house is an edifice erected and designed for the purpose of human habitation." In the same way, in teaching drawing, never expect a child to learn anything from the words of a definition. Let him get his idea from the thing itself, but when he is fully acquainted with the *thing*, there can be no objection to telling him the *name* of it, unless the name is too large for his powers of pronunciation.

EXERCISE 25.—A border, combining both the rectangle and the rhomboid. In this exercise the pupil will find his greatest difficulty in drawing the inclined lines, but this will be lessened if attention is called to the points in the dotted horizontal line, where the inclined lines cross it.

#### PAGE 11.

On this page are review exercises, combining, in forms which will be pleasing to the children, the lines and figures which they have been drawing heretofore.

EXERCISE 26.—The length and direction of the lines required in completing the drawing of the envelope, are indicated by the dotted lines.

EXERCISE 27.—In drawing the chest, on the board, first make a rectangle proportioned like the chest. The upper and lower sides are one-third longer than its vertical height. Then draw the lines representing the different parts. Absolute accuracy in proportioning the parts to each other is not essential.

EXERCISE 28.—This example needs careful drawing. Watchfulness on the part of the teacher will alone secure this.

#### PAGE 12.

EXERCISE 29.—This figure contains lines longer than any the pupil

has been required to draw heretofore. To draw these well requires a trained hand. This exercise, therefore, will be likely to give the pupil all that he can do, and the result may be a disappointment. The longest lines may be a little crooked, and they may not be of the same breadth and strength throughout. If this should not prove true, the teacher may congratulate herself on having secured, in a wonderful degree, the main object aimed at in this book — the training of the eye and hand.

---

## BOOK II.

Teachers using Book II. should make themselves familiar with the directions given for teaching Book I.

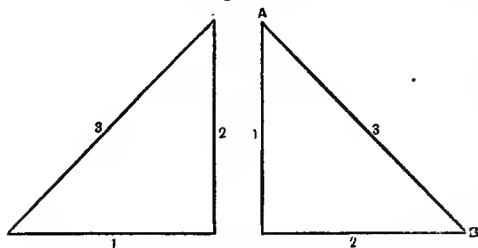
The triangle is now introduced as a figure by itself for the first time in these exercises. The pupil has drawn the figure many times, but always in connection with some other figure. Attention has not been called to it before, because it was not desirable to divert the pupil's mind from the figure which formed the subject of the lesson. One thing at a time, and time enough devoted to that thing to make it somewhat familiar before anything else is taken up, is one of the leading ideas upon which these lessons are based. The teacher who adopts this maxim will have done a great deal to secure success. Make it an invariable rule to confine the attention of the class exclusively to the subject of the lesson, even though that afford you an excellent opportunity to introduce something else incidental to it. To fix a given form definitely and accurately in mind, everything but that must be put out of sight, and the more closely our attention and thought is confined to it, the more rapidly and the more accurately we become acquainted with it.

### PAGE I.

EXERCISE 1.—We have here a right angled triangle, or a triangle in which one of the angles is a right angle. In drawing the figure in this position, independent of anything else, the lines should be drawn in the

order indicated by the numerals in Fig. 39. Where two lines meet, forming an acute angle, as at A and B, great care should be taken in drawing.

Fig. 39.



Any trifling variation from accuracy here is quite noticeable, and the more acute the angle, the greater the difficulty. The space between the lines should be clean and its edges sharp to the terminal

point. Connect the points given by fine lines, and when a correct sketch has been obtained strengthen these lines.

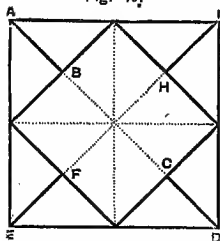
EXERCISE 2.—The example here given consists of equilateral triangles, or triangles having three equal sides and three equal angles. Problem 9 furnishes the information necessary for the teacher in drawing this exercise on the board.

In guiding the efforts of the class, keep in mind the direct purpose of these lessons:—the education of the hand and eye, enabling the pupil to draw lines in any required direction; to make them broad or narrow, light or dark, and of uniform breadth and strength throughout:—a knowledge of the order in which the lines should be drawn to produce the best results, and in addition to this, the acquisition of neatness.

EXERCISE 3.—This is an Egyptian border. A few questions will lead the class to discover that it is simply a repetition of the figure which they drew in Exercise 2. Every other triangle being inverted as in that exercise. This figure calls for great care in execution. The work must be done neatly to look well. Adjoining sides should terminate exactly in the same point. Each line should be of the same breadth and strength throughout, and all should be of equal strength. The nearer the scholars are able to approach this in their work, the better will be the result.

## PAGE 2.

**EXERCISE 4.**—This is a square inscribed within a square, with their diagonals. Sketch the outer square; place points in the middle of each of its sides; draw lines connecting the opposite points; draw the inscribed square. Place a point in the middle of each side of the inscribed square. See that the points corresponding to A B C and D form a straight line, as they should. See that the same is true of the points E F H and I, and when correctly placed connect B F C and H with the vertices of the angles in the outer square, as in the example. Complete the drawing by giving to each line the strength required. The course here described is such as should be followed if none of the points were given. A similar course will be pursued in the description of all subsequent figures.



**EXERCISE 5.**—This is merely a repetition of Exercise 4. The figure is to be repeated three times. From the sketch given it will be readily seen just what is required to complete the drawing. The repetition of this figure gives a series of over-lapping squares, a not uncommon arrangement in designs of this kind where the square is used.

## \* PAGE 3.

**EXERCISE 6.**—This example furnishes a good exercise in drawing straight lines, and is quite as likely to interest young children as a more ornamental form. The pupil is here called upon for the first time to locate points for the termination of lines. In the drawing, points in the outline have been omitted. The teacher can best decide how the exercise shall be conducted in locating these points.

**EXERCISE 7.**—The figure here given is to be repeated twice. The pupil is again called upon to locate points for the extremities of lines.

## PAGE 4.

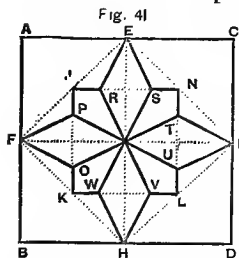
**EXERCISE 8.**—This example furnishes further practice in drawing straight lines, and while introducing the geometrical forms, with which

the class are now familiar, it at the same time relieves the monotony of drawing them merely as such.

**EXERCISE 9.**—In this exercise, the figure given is to be repeated. When a part of a figure is covered by another part, as in this example the broken lines should, in making the sketch, be made continuous, and when the sketch is complete, the parts not wanted are to be erased before strengthening the lines.

## PAGE 5.

**EXERCISE 10.**—In placing this figure on the board, draw the square,

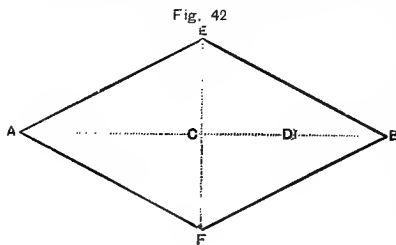


ABDC; place a point in the middle of each side and draw the lines EH and FI, connecting opposite points. Draw the square EFHI; place points as JKL and N, in the middle of the sides; draw the square JKLN; place points dividing each side of this square into fourths. The extremity of each line in the outline of this figure is now determined. Draw FO, FP, ER, ES, &c., completing the figure.

**EXERCISE 11.**—In this exercise we have an arrangement of lines found in tile work, prints, wall papers, carpets, &c. The order in which the lines should be drawn is a matter of no special importance, provided the course adopted is such that the hand does not necessarily come in contact with the work already performed.

## PAGE 6.

**EXERCISE 12.**—This is a rhombus or lozenge, a figure having all its



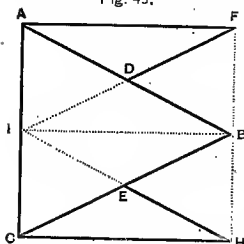
sides equal, but its angles not right angles. It is like the square in having its sides equal, and like the rhomboid in having its opposite angles only, equal. The long diagonal in this figure is twice the length of the short one. This ratio may vary to the

point where the diagonals become equal, when the figure becomes a square.

In placing this figure on the board, draw  $AB$  of any length. Place the point  $C$  in the middle of  $AB$ , and  $D$  midway between  $C$  and  $B$ . Taking  $CD$  as a measure, place  $E$  vertically over  $C$  and at a height above it equal to  $CD$ . Place  $F$  vertically under  $C$  and as far from it as  $E$  is from  $C$ . Connect the points  $A E$ ,  $E B$ , &c., completing the figure. Let the pupils draw as follows: from  $A$  to  $E$ , from  $E$  to  $B$ , from  $A$  to  $F$ , and from  $F$  to  $B$ .

**EXERCISE 13.**—In the first part of this exercise, complete the drawing

Fig. 43.

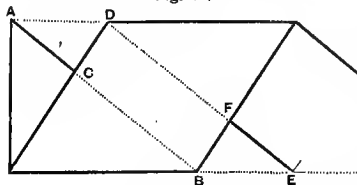


by strengthening the faint lines. In completing the sketch in the lower figure, that part of the rhombus represented by the dotted lines need not be drawn. Sketch the lines corresponding to  $AB$  and  $CB$ . Place points, as  $D$  and  $E$ , in the middle of  $AB$  and  $CB$ . The knowledge of the fact that a straight line drawn from  $I$  to  $F$  will pass through the middle point of  $AB$  will be a great help in securing accuracy. In placing points corresponding to  $D$ , the attention of the class should be called to this fact.

## PAGE 7.

**EXERCISE 14.**—The border in this exercise is made by repeating alternately the rhombus and rhomboid. In making the sketch, outline the

Fig. 44.



rhombus first in each case. Then locate the points corresponding to  $C$  and  $F$ , being careful to place  $C$  in a line with  $A$  and  $B$ , and  $F$  in a line with  $D$  and  $E$ . As each point is placed, sketch the connecting lines.

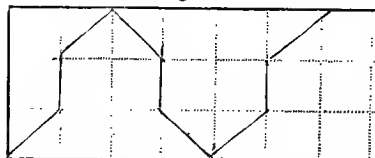
**EXERCISE 15.**—The object represented furnishes an exercise in drawing rectangles. A few of the guide points are to be located by the pupil.

This should be done with great care, and the accuracy of their position should always be tested before the lines are made. The pupils will need special attention when strengthening the long lines in this drawing.

## PAGE 8.

EXERCISE 16.—The teacher should not fail to dictate the drawing of

Fig. 45.



each line in this exercise, using an example on the board, otherwise the pupil will be likely to connect points which should not be connected with one another. In strengthening the lines, the ut-

most care should be taken to have each angle clean and sharp. Faults to be avoided are here represented.

EXERCISE 17.—Several points needed to complete the outline have been left for the pupil to supply. In adding these points, place first the one required to complete the panel on the left. Then the two corresponding points in the other panel, and last of all those in the outline of the foot.

Parallel lines lying very near each other should be drawn with great care, for any slight deviation from accuracy is quite apparent, and the nearer the lines are to each other, if error exists, the more obvious the error will appear. The pupils will need to be cautioned, therefore, when strengthening the lines in the upper part of the drawing. If the point of the pencil is dull or blunt, failure is certain.

## PAGE 9.

EXERCISE 18.—The rhombus forms the basis of design in this exercise. The whole border is a repetition of rhombs and parts of this figure. The smaller figures are complete, while the lower half of each of the larger figures is omitted.

EXERCISE 19.—The more minute the representation, the more careful and accurate the drawing must be. The rectangular forms, representing the hinges of the door in the example, are likely to cause more trouble,



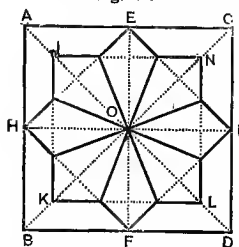
if well drawn, than the larger rectangular forms representing the panels of the door.

## PAGE 10.

EXERCISE 20.—The remarks made under exercise 17 about the difficulty of drawing parallel lines lying near each other, and the need of more than ordinary care when several lines meet in one point, apply in drawing this exercise.

EXERCISE 21.—The most ready way to secure an accurate copy of this

Fig. 46.

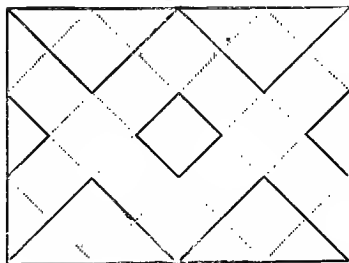


exercise on the board, is to draw the square A B C D, and its diagonals, A D and B C. Then through O, the point where the diagonals intersect, draw E F and H I. Connect the extremities of these lines, forming the square H E I F. With a string measure the distance from O to E, and lay off this measure on the diagonals from O. This gives the points J K L and N. Draw the square J K L N, and erase such lines as do not

form part of the example.

## PAGE 11.

Fig. 47.



EXERCISE 22.—The accompanying figure contains the construction lines needed in placing this exercise on the board. A few of the points in this exercise are to be located by the pupil.

## PAGE 12.

EXERCISE 24.—The most difficult thing the pupil has to do in the exercise on this page, is in drawing the lines representing the shelf. The utmost care will be required in drawing these lines or the pupil will run them together.

## BOOK III.

Up to this point straight lines only have been given. The term has probably been used, though no definition may have been required. As the present book deals largely with curved lines, it will be necessary now for the pupil to distinguish between the two kinds of lines. This distinction may be illustrated by drawings on the board, and still better by objects in the school room.

Whether it be formulated or not, the fact will be made clear that a straight line is one that does not change its direction at any point; that it is the shortest distance between two points, while a curved line is one whose direction changes at every point.

The arc of a circle is the most simple of all curves, and is the only curve used in this book. Distinguish between the circle itself and the circumference; the latter is merely the line which encloses or bounds the space, as the four sides bound the square, or as a fence encloses a field. The peculiar feature of the circumference is that all points in it are equally distant from a point within the figure, called the centre. Illustrate by drawing a circumference with a string and crayon. Any line passing through the centre, and whose extremities are in the circumference, is called a diameter. A straight line connecting the centre with any point in the circumference is called a radius of the circle. Two or more such lines are called radii.

Curved lines are more difficult to draw than straight lines. It requires no great keenness of perception to see that a line is straight; but it does require a sharp eye to detect, at a glance, the exact sweep of a curve; and no greater mistake can be made than to assume that the pupil *must see* this because the line is before his eyes. Study alone will give the eye that keenness of perception necessary to enable him to do it. The common practice of allowing the pupil to proceed at once to drawing, without first making the example a study, is why so much time is spent in learning to draw. Pupils are permitted to draw too much; and they are required to study too little. It is an absurdity to suppose that any one can accurately represent a form of which he has no definite

knowledge; and yet, in utter disregard of this self-evident truth, pupils are permitted to spend all the time devoted to drawing in attempting to do it. The great majority seem to act on the supposition that the power to draw resides in the *hand*, and not in the *head*. The hand needs discipline; but the eye, the organ through which the mind receives its knowledge of form, needs it a great deal more, in the great majority of cases. As a rule, there need be little anxiety that the hand will be found incompetent to perform all that the mind has the knowledge to direct.

On taking up a new example, call the attention of the class to every line in it; taking each line in its turn, question them in regard to all the facts connected with it; point out what they fail to notice, and, before they are allowed to put their pencils to paper, be sure that they have an accurate knowledge of the form to be represented, and that they understand what course to pursue in making the drawing.

Unless there is more than usual care exercised in drawing these examples, they will be very likely to be wanting in accuracy. The importance of requiring of the pupils all that it is reasonable to expect of them in this respect cannot be too strongly urged upon the teacher.

A curved line should not be drawn by making a series of dots; neither should it be made in little pieces. By this we do not mean that all lines should be drawn from beginning to end without taking the pencil from the paper. The idea that we wish to convey is, that each stroke should be as long as it can be conveniently made, all things considered.

In drawing these examples, let all lines be made very light at first,—just dark enough to be clearly visible; and let each stroke of the pencil, whether it be good or bad, remain until an accurate outline has been secured; then the true line should be strengthened; and, when this has been done, the false should be removed. A false stroke has its use; it serves as guide to a correct one. With the false line before him, the pupil will be the better able to judge where the true line should be.

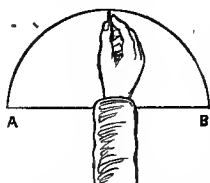
It is a common notion that all lines should be drawn *firmly*, and *at once*. It is said that Giotto once drew the outline of a circle with one stroke of his pencil. Whether this story is true or false, one thing is

certain,—Giotto is the only man that ever had the credit of doing it. Where strict accuracy is required, the professional draughtsman, in drawing any form bounded by curved lines, always makes more or less false strokes; and this induces him to first sketch in the outline faintly, as we have recommended. This is the common practice where accuracy is demanded; and now, since this is so, is it not folly to ask a child, with hand and eye untrained, to attempt what those skilled in art cannot do?

In drawing a curved line, the motion of the hand should be sufficiently slow to allow the mind ample time to judge of its accuracy as the pencil moves from point to point. It is the mind that considers and determines the sweep of the curve, and the mind must guide and prompt the hand in drawing it. A bold and dashing line with the beginner is always a *reckless line*.

Before attempting to draw a curved line, care should be taken to have the hand and arm properly placed. If there is a failure here, the line cannot be drawn with ease, and therefore it is not likely to be well drawn. When the hand is on the paper, before making each stroke, go through the motion of drawing the line; and, if it cannot be made with ease, change the position of the hand or arm, as may be necessary to secure the desired result.

Fig. 48.



As a rule, the arm should be at right angles to the chord which subtends the arc. In drawing an arc of considerable length, keep the arm in one position as long as convenient; but change as soon as the position becomes constrained. In Figure 48 the arm is perpendicular to the chord A B.

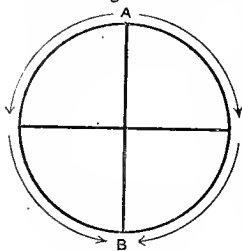
In regard to the position of the book, when drawing or tracing curved lines, it is quite likely that the pupil, if left to himself, will be tempted to turn the book in drawing various parts of the line, perhaps to the extent of turning it entirely around. This should not be allowed. As a rule, the lower side of the book should be kept parallel with the front

edge of the desk. If it is necessary, in order to secure the proper position of the hand, the book may be slightly turned.

## PAGE 1.

EXERCISE 1.—Simple tracing is the work to be done on this page. The fine hair lines of the curves are to be made equal in strength to the strong lines in the example. Let the pupil pass the point of the pencil over the curves, holding it near—but not quite touching the paper. This should be done at the dictation of the teacher. Let the position of the arm be changed from time to time, as may be necessary in order to

Fig. 49



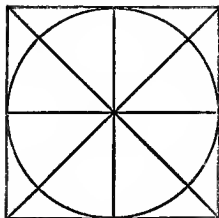
trace the line without constraint. Let this exercise be repeated a reasonable number of times, that the hand may become somewhat accustomed to the motion required in strengthening the lines.

Draw with a downward stroke. In drawing the arc or circumference, draw from A to B on the left, and then on the right as indicated by the arrows.

## PAGE 2.

EXERCISES 2 AND 3.—In placing the figure found on this page on the board, draw a square; draw lines connecting the

Fig. 50.



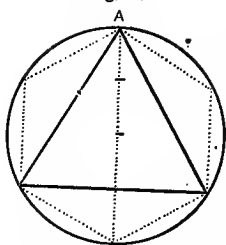
middle points of the opposite sides, and, also, the diagonals. The point of intersection will give the centre of the circle, and the lines just drawn will be the straight lines used in this figure.

As in Lesson 1, the pupil is to trace the fine hair lines, making them equal in strength to the lines in the example.

## PAGE 3.

EXERCISES 4 AND 5.—The work here consists of both tracing and drawing. The course of the lines is clearly indicated by the parts given.

Fig. 51.

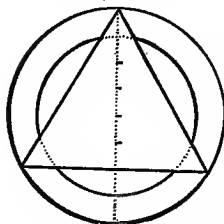


In placing this figure upon the board, draw the outer circle. Starting at A with the radius of the circle as a measure, lay off points on the circumference, as indicated by the dotted lines. Connect the alternate points as shown in figure.

Another method of doing this would be as follows: Draw the circle, and from the point A, draw a vertical line passing through the centre to meet the circumference. Divide the lower

half of the line into two equal parts. Through the point of division, draw a line perpendicular to the vertical line, with both of its extremities in the circumference. Connect its extremities with A.

Fig. 52.



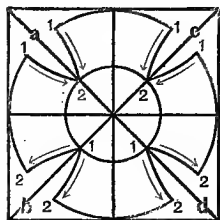
Divide the line representing the altitude of the triangle into six equal parts. The upper point of division will be the point through which the inner circumference is to pass.

Remember that it is important now for the pupils to form correct habits, and that they need constant attention and guidance, especially, with reference to the position of the arm and book.

#### PAGE 4.

**EXERCISE 6.**—In drawing the figure used in this exercise, on the

Fig. 53.



blackboard, make the circle inscribed in the square. The diameter of the inner circle is a trifle less than one-half of that of the outer. On the circumference of the outer circle, lay off on each side of the points where it is cut by the diagonals of the square a distance equal to one-sixth its radius; and through the points thus obtained, draw the curves corresponding to 1 2

in the figure.

The pupil should form the habit of drawing the lines in the proper

order. In drawing the curves corresponding to 1 2, he should draw in the direction indicated by the arrows from 1 to 2, and in the order indicated by the letters, a, b, c and d.

An error likely to occur here will be the extending of the lines beyond the point where they should terminate, or falling short of it. Failure in either respect will mar the beauty of the figure.

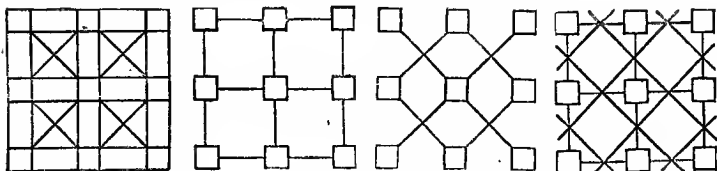
EXERCISE 7.—This is an application of the principles already described.

## PAGE 5.

EXERCISE 8.—The drawing to be done in this lesson is to be dictated by the teacher. Place the figure on the board as given in the book. Unless a long ruler is at hand, in arranging the squares it may be convenient to use a chalk line.

Any one of the designs given below may be dictated.

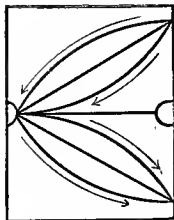
Fig. 54.



EXERCISES 9 AND 10.—The figures here given are to be traced.

## PAGE 6

EXERCISE 11.—This is a border of leaf forms, composed of arcs of the circle. For blackboard drawing, sketch the horizontal line first, and then draw the lines representing the mid-ribs of the leaves, as these lines serve as guides in drawing the curves. Owing to the position of the inner curve of each leaf, these lines will be found more difficult to draw or trace than the outer curves. Special attention will, therefore, be required on the part of the teacher.



EXERCISE 12.—This is a quarterfoil. The sides of the square are

divided into fifths, the diameter of each of the circles being equal to three-fifths the length of either side. As this measurement is somewhat complicated, a near approach to it will answer as well for dictation as one of perfect accuracy.

## PAGE 7.

EXERCISE 13.—The figure in this exercise is simply that in Exercise 11 reversed. Great care must be exercised in drawing the curves in the upper leaves as they are much more difficult to draw than those in the lower.

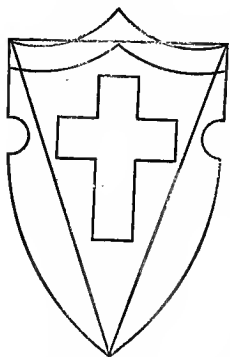
EXERCISE 14.—This example is to be traced. Pay special attention to neatness and accuracy of execution.

EXERCISE 15.—In drawing this example keep the pencil sharp and draw with great care. The double lines representing the band ornamenting the cup need not be traced.

## PAGES 8 and 9.

EXERCISES 16 TO 21 INCLUSIVE.—The figures upon these pages are lance shaped, with curvilinear, acute and obtuse angles. The first border, Exercise 16, is a succession of arrow-head leaf forms, and makes

Fig. 56.



a good exercise for the board. The shield, Exercise 18, furnishes a pleasing combination of curved lines. The sides of an isosceles triangle of the same proportions may be sketched on the board, and the curved lines drawn upon them as in the accompanying cut. The ratio between the height and width of the cross is as 4 to 3.

The leaf forms given on this and the next page are much too difficult for pupils of this grade to draw; but as exercises in tracing, they afford good practice in making curved lines, and cultivate the taste of the scholars, by introducing a class of work which ordinarily belongs to a much later period.

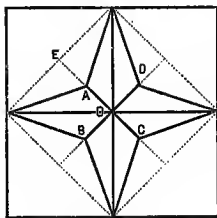


The sides and perpendicular of an isosceles triangle are lines upon which the curves of Exercise 19 are made.

**EXERCISE 21.**—This is an ornamental form. From the guide lines given, the teacher will readily see how to proceed in placing this figure on the board.

PAGE 10.

**EXERCISE 22.**—This is an exercise in drawing and tracing. The drawing is to be completed as indicated in the first part of the figure. Then, if the teacher deems it desirable, a point may be placed in the middle of each side of the larger squares; and these points may be connected with each other, so as to form a series of inscribed squares. This will furnish an opportunity to exercise the pupil in estimating distances.



**EXERCISE 23.** This is an exercise in dictation. The points A B C and D divide the lines corresponding to E O into equal parts. Require the pupils to locate these points and then to draw lines as represented in Figure 57.

**EXERCISE 24.**—The figure here given is to be traced.

PAGE 11.

**EXERCISE 25.**—In this border a conventionalized form of the thistle is used. The curved lines are easy and graceful, and make a good subject for work on the board. The resemblance to the thistle may be pointed out to the children. Perhaps they will notice it themselves, if questioned upon the point. The teacher may make a drawing representing the thistle, and then demonstrate the similarity to the conventional form. This form is one common to vases. The teacher can take

this occasion to call the attention of the class to the fact that many objects of every-day life are but slight modifications of natural forms.



**EXERCISE 26.**—In the drawing of the cup in this exercise, the figure is reversed to secure symmetrical arrangement. The corresponding sides of the cup being contrasted in this way: a figure is formed between the two drawings whose opposite sides are alike. This would not be the case if the drawing was not reversed. Take this as an opportunity to impress on the minds of the class the advantage arising from symmetrical arrangement.

## PAGE 12.

**EXERCISE 27.**—We have here a mirror and mantle similar to that found at the close of the previous book. Curved lines are employed here, and give a more graceful outline than that obtained from the somewhat rigid arrangement of straight lines.

## BOOK IV.

The general remarks on page 34 relating to Book III., are applicable as an introduction to Book IV.

In this book we introduce the reversed curve, or what is generally known as the compound curve, for the first time. The exercises are made up of straight lines, simple and compound curves; giving the pupils further practice in curves with which they are now somewhat familiar, besides making them acquainted with the new class of curves, to which reference has been made.

It is our object to deal with but one thing at a time. An opportunity is thus furnished to give the pupils a thorough drill on one class of curves, before taking up another. The common practice of giving the pupil a single lesson on one class of curves, and immediately taking up another class with which he is not familiar, is a great hindrance to his success, as it affords no opportunity to become acquainted with any one of them. Giving him an example, involving the arc of a circle, to-day; one introducing the oval, to-morrow; followed



by an application of the spiral, on the next day, is like carrying him from addition to fractions, and back again to long division, with no previous knowledge of either.

## PAGE 1.

**EXERCISE 1.**—The example given represents a common form of vase. The first exercise consists in strengthening the faint outline given. Special care should be taken with that part of the line where the curves unite, that no angle may be formed. The lines should flow into one another smoothly, without a break. Following this is an exercise in drawing and tracing the same form. No better subject than this can be found for blackboard work. A great variety of vase forms may be obtained by varying the guide lines, the degree of curvature and the proportionate length of the curves.

**EXERCISE 2.**—In conducting this exercise follow the suggestions for Exercise 1. The double lines in this example are not to be traced.

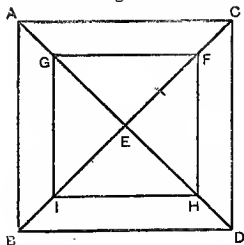
**EXERCISE 3.**—The difficulty likely to occur here is in drawing that side of the pitcher on which the handle is placed.

## PAGE 2.

**EXERCISES 4 AND 5.**—By the repetition of the figure given on this page, a very pleasing design for a border is formed. In tracing the lines in Exercise 4, aim at neatness and accuracy. In regard to Exercise 5, no special suggestions are required.

## PAGE 3.

Fig. 60



**EXERCISES 6 AND 7.**—In drawing the figure on the board, make a square,  $A B C D$ , and its diagonals. Divide one-half of either diagonal, as  $E C$  into thirds, and through the upper point of division  $F$ , construct the square  $F G I H$ . Draw the circles cutting off the corners of the squares.

## PAGE 4

**EXERCISE 8.**—In this border a conventional form of the acorn is used.

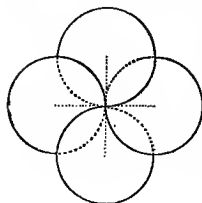
Fig. 61.



The resemblance between the natural form and that used may be referred to at the beginning of the lesson. The class will, by such conversational exercises, easily become acquainted with the demands for, and uses of, conventionalized forms.

In most instances, a literal representation of the object which forms the basis of design is not desirable, because of its multiplicity of detail. Where there is much detail there cannot be breadth, which is one of the prominent essentials of ornament.

In natural forms, perfect symmetry is seldom found. This is also one of the essentials of ornamental form.



**EXERCISE 9.**—This exercise consists of an arrangement of four circles. In placing this figure on the board, the accompanying cut will furnish all the instruction necessary. Having drawn the entire outline of the circles, erase the parts represented by dotted lines.

## PAGE 5.

**EXERCISE 10.**—In this exercise, begin by making a sketch of the eight squares enclosing the figure formed by the curved lines. Next sketch their diagonals, and the horizontal and vertical lines passing through their intersection; and also, the diagonals of the small squares. Then carefully sketch the curves; and finally, strengthen the lines.

**EXERCISE 11.**—A part of this figure is given in faint lines. The parts omitted should be like those given. Sketch these parts, making the straight lines first, and when a reasonably accurate sketch has been made strengthen the entire outline of the figure.

**EXERCISE 12.**—The lines in this example are to be strengthened. Special pains must be taken with this exercise.

## PAGES 6 and 7.

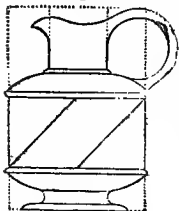
EXERCISES 13 TO 16 INCLUSIVE.—The figures forming the borders on each of these pages are given in the drawings at the bottom of the page.

The teacher should not now experience any difficulty in drawing these examples on the board.

## PAGE 8.

EXERCISE 17.—A quarterfoil. The diameter of each circumference used is equal to one-half the length of either side of the square.

Fig. 63.

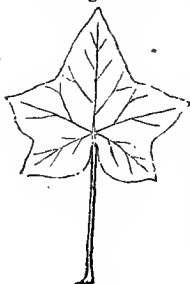


EXERCISE 18.—In placing this example on the board, proceed as follows:—Draw the rectangle; draw the body of the pitcher; draw its neck and base; then its lip and handle.

## PAGE 9.

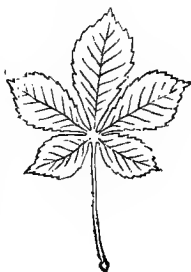
EXERCISE 19.—This is simply a combination of semi-circumferences, with rhombs. Complete the sketch as indicated by the hair lines in the first part of the example. This exercise is more difficult than any the pupil has yet had placed before him, and he will, therefore, need special attention from the teacher, while the sketch is being made. Each line should be dictated by her.

Fig. 64.



EXERCISES 20 AND 21.—These exercises in tracing are conventionalized forms of the ivy and horse-chestnut leaves; literal drawings of which may be made on the board, that the pupils may see the difference between the forms given and the natural forms.

Fig. 65.



## PAGES 10 and 11.

- No instructions need be given for the exercises found on these pages. The teacher will readily see all that is required.

## PAGE 12.

EXERCISE 28.—The ivy leaf and berries are here used in a border. The form of leaf used here differs materially from that of the same leaf given on page 9; and yet, both present its leading characteristics.

EXERCISE 29.—The vase here given will be a good subject for black-board work.



PAYSON, DUNTON & SCRIBNER'S

**SUPERIOR STEEL PENS.**

Extra Fine, No. 333, fine smooth points, per gross,	72c.
The National Pen, No. 455, medium Points, per gross,	72
The Business Pen, No. 7, large size, coarse points, per gross,	72
The Ladies' Pen, No. 8, very fine and elastic, per gross,	72
Commercial Pen, No. 111, medium fine points, per gross,	72
The Excelsior Pen, No. 117, smooth points, very flexible, per gross,	84
The Engrossing Pen, per gross,	72

---

Catalogues and Circulars SENT FREE on application. Correspondence solicited.

**POTTER, AINSWORTH & CO.,**

**107 CHAMBERS STREET, NEW YORK.**

**CHICAGO.**

**BOSTON.**



# STANDARD TEXT BOOKS.



PAYSON, DUNTON & SCRIBNER'S COPY BOOKS.

BARTHOLOMEW'S NEW DRAWING SERIES.

DINSMORE'S GRADED SPELLING BLANKS.

PATTERSON'S COMPOSITION BOOKS

CROSBY'S GREEK TEXT BOOKS.

HANSON'S LATIN COURSE.

THE CAMBRIDGE COURSE OF PHYSICS.

WILSON'S TREATISE ON PUNCTUATION.

---

Catalogues, etc., furnished. Correspondence Solicited.

---

POTTER, AINSWORTH & CO.,

107 CHAMBERS STREET,

NEW YORK.

